DOCUMENT RESUME

ED 350 268 SP 034 035

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TITLE Conceptual Change and Teacher Education: Impact of Our Research on Our Practice.
PUB DATE 20 Apr 92
NOTE 12p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 20-24, 1992).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Educational Change; Educational Research; Elementary Secondary Education; Foreign Countries; Higher Education; *Preservice Teacher Education; *Research Utilization; Student Teachers; *Teacher Education Programs; Teacher Improvement; *Theory Practice Relationship
IDENTIFIERS *Conceptual Change; *Monash University (Australia)

ABSTRACT

The paper examines ways in which ideas from conceptual change research have been applied to teacher education, focusing on the teacher education program at Monash University (Australia). Three developments have contributed to a sounder basis for linking interest in conceptual change research to practice at Monash University: (1) the research effort was interpreted within more comprehensive theories of learning; (2) research ideas were applied to the reform of teacher education programs; and (3) there was increased collaboration between teachers and academics in translating research activity into practice. Conceptual change at Monash University focused on understanding, alternative frameworks, metacognition, and a more contemporary view of constructivist learning ideas. It related to critical conditions that led to transformation in the teacher education program. The paper lists five propositions that were expressed early in the reform of the teacher education program and have provided a focus for continual review of the program. The third proposition (student teachers are actively constructing views of learning and teaching based on personal experiences and strongly shaped by perceptions held before the beginning of the program) is particularly relevant to conceptual change. Discussion of the propositions in light of continuing issues and future challenges concludes the paper. (SM)

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ED350268

Conceptual Change and Teacher Education: Impact of our research on our practice

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Paper presented at the symposium Critical Issues in Conceptual Change at the annual conference of the American Educational Research Association, San Francisco. April 20-24, 1992.

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Conceptual Change and Teacher Education:
Impact of our research on our practice

Introduction

A significant proportion of the research in conceptual change is carried out by people responsible for teaching in teacher education programs. This research effort had had considerable impact on curriculum and teaching (eg. Northfield and Symington, 1991) and one might expect the ideas to have influenced the practice of teacher education - both preservice and inservice. However, any extended experience in educational research will result in one general conclusion - the link between ideas and practice is complex. Fullan (1991) reminds us of the myth of "brute sanity" (p.92) as the major approach to achieving change and improvement and Hewson (1981) begins to "unpack" the challenges involved in change when he identifies the need for ideas to be seen as intelligible, plausible and fruitful. We may have become used to research having limited impact on practice but when the research effort is directly related to other aspects of our professional role there is a particular interest in applying the ideas, further heightened when difficulties in implementation arise. This paper sets out to promote discussion about the way ideas from conceptual change research have been applied to teacher education. What has been done? What has worked and what difficulties have been experienced in revising teacher education programs? The round-table discussion format is an excellent opportunity to share the experience and understanding among those people who have seen the implications of their research for their own teaching. The first section examines the link between research and practice as it applies to conceptual change research and teacher education.

Has the research effort affected the nature of teacher education programs?

What factors have operated to facilitate and inhibit links between the research effort and teacher education practice?

This will be followed by an outline of the way one teacher education program has been reformed as a stimulus for considering a further question.

In what ways have teacher education programs changed to accommodate our understanding of conceptual change?

Finally, the symposium is an opportunity to share ideas and activities that might address current issues and priorities?

What are the current issues and priorities as we link conceptual change perspectives with our teacher education programs?

What useful ideas and activities can participants contribute to address these issues and priorities?

The link between research on conceptual change and teacher education

The late 70s saw an increase in interest in research on understanding. Techniques for probing the understanding of scientific concepts were developed (White, 1988) and we were reminded that students have well developed and persistent conceptions which differ from accepted scientific ideas (variously called Children's Science, Alternative Frameworks). The impact of this research interest on teacher education programs was immediate although often superficial. The probing techniques were introduced (often revealing misconceptions among the student teachers) and there were efforts made to revise curriculum materials and teaching approaches in ways that were intended to address and replace alternative conceptions in students. The research activity seemed important but it proved difficult to incorporate the ideas in any sustained way into teaching/learning approaches at teacher education and school levels. The persistence of existing ideas amongst learners and the structure and organisation of formal education were to require more substantial efforts. Some first attempts to apply the ideas had limited impact but certainly indicated the extent of the challenge (Northfield and Gunstone, 1983, 1985).

Three developments have contributed to a sounder basis for linking the conceptual change research interest to our practice. Firstly, the research effort was interpreted within more comprehensive theories of learning. Osborne and Wittrock (1985), Posner et.al. (1982), White (1988) provided contemporary views of constructivist learning which seemed to incorporate the research findings into more coherent frameworks. A second development was the application of the research ideas to the reform of teacher education programs (Northfield, Erickson and Gunstone, 1992; Carr et.al., 1986). This development enabled deeper understanding to emerge from the experience of trying to present teacher education in ways that better represented our aspirations for school learning and teaching.

The third development in translating research activity into practice involved a more effective collaboration between academics and teachers. If the research effort was to influence practice in significant ways it became clear that teachers would have to lead the way. Teachers would have to become learners as they tried to develop classrooms more compatible with conceptual change perspectives on student learning. Baird and Mitchell (1986) document the first year of a group of teachers striving to interpret, reshape and implement new teaching/learning strategies. These teachers became crucial in establishing what was possible and a subsequent review (Baird and Northfield, in press) has highlighted the importance of the academic-teacher collaboration. Such collaboration was not easy to achieve, but recent experience suggests we have learned a great deal about establishing and gaining benefits from the relationship between academic and teacher researchers.

> *"We've all heard about the ivory tower and I think sometimes we teachers believe that it's not only the personnel of that rarefied atmosphere that are unapproachable and distant, but the theories that emerge from it also. I, for one, no longer believe this is true. I've always found that if you sit down with a student, you can usually thrash out ideas much more effectively than as a whole class or by shoving a textbook - even a good one - under their noses .... The same*

is true of the relationship between practicing classroom teachers and academics. If there is personal interaction rather than lectures and books, the ivory tower can become a hub of activity, a veritable hot house of exotic and more ordinary ideas." (Teacher from the PEEL project, Baird and Northfield [in press]).

The contribution made by the teachers to the understanding by academics included

"... an appreciation of the complexity of factors determining the success or failure of an innovation, an increased awareness of the links between two separate areas of research (research on metacognition and research into alternative views held by students in science), a changed view of the relationship between research and practice, and a changed view of the function of schools ..... They (the academics) also listed a number of ways they had used PEEL in various courses and inservice activities". (Baird and Northfield [in press]).

I would therefore argue that the conceptual change emphasis which focused on understanding, alternative frameworks, metacognition and a more contemporary view of constructivist learning ideas was associated with critical conditions that have lead to a transformation of teacher education. *Is this the experience of other symposium participants?* The remainder of this paper is concerned with the nature of this transformation. *In what ways have teacher education programs changed to accommodate our understanding of conceptual change?* A review of one teacher education program will be outlined to provide a basis for thinking and discussion.

Rethinking approaches to teacher education

The list of propositions set out as Table 1 formed a set of guidelines which were expressed early in the reform of one teacher education program. The education of teachers was to be viewed as a particular application of conceptual change perspectives and these

propositions allowed for a review of existing practices. They still form the basis for considering new initiatives.

Table 1

Propositions guiding the continuous development of a teacher education program

1. The prospective teacher has changing needs and priorities which must be considered in planning and delivering the program.
2. The transition from learner to teacher is difficult to achieve and is greatly facilitated by having prospective teachers work in a collegial environment.
3. The student teacher is a learner who is actively constructing views of learning and teaching based on personal experiences and strongly shaped by perceptions held before beginning the program.
4. The program should model the teaching learning approaches being advocated.
5. Student teachers should see the preservice program as a worthwhile experience but only the first stage of a career-long professional development.

The list of propositions have been used for more than a decade, but the way they are understood and interpreted continues to change. Proposition 3 addresses the conceptual change perspective and we would now argue that two conditions are necessary if conceptual change is to occur. Firstly, presenting conceptual change as a unique personal construction of meaning has been criticised as accepting relativistic, "anything goes" learning outcomes. To address this concern proposition 2 has become crucial. Learning to be a teacher requires significant contact with colleagues. With the opportunity to develop personal meaning comes the responsibility to be prepared to defend and reconsider ideas with colleagues, and later in their career, fellow teachers, parents and pupils. From a conceptual change perspective, teacher education is best seen as a process of continuous learning about teaching that ideally requires interaction with colleagues.

A second condition relates to the way in which existing perceptions may be altered. Ultimately, the reconsideration of existing perceptions in light of new experiences is under the control of each individual. Hewson (1981) proposes that the new idea must be seen as

more intelligible, plausible and fruitful than existing ideas if it is to become part of a person's thinking. A prospective teacher must be willing to examine existing views and have the skills to monitor and assess the development of alternative ideas. We would now argue that a crucial part of any teacher education program is the provision of opportunities to develop the metacognitive skills needed to monitor the conceptual changes we associate with learning to be a teacher.

The importance of metacognition has been a more recent development in the way research related to conceptual change has been interpreted and applied to the teacher education program. Developing activities to take account of this new emphasis has become a further challenge.

Applying proposition 3 has provide difficult in a number of respects. At preservice level new teachers, although successes in the educational system, often have limited experience of active learning and a wide range of teaching/learning approaches. A teacher education approach that accepts existing perceptions, while providing a wide range of novel teaching/learning experiences, is a major departure from the previous education experience for many students. A proportion of students expect to be trained in specific techniques and look for clear guidance and answers. Before they regard their learning about teaching as a personal construction of meaning they will need to see their prior learning experiences as requiring careful reflection. Teaching strategies that probe for understanding are likely to reveal limits to their own understanding in especailly in content discipline areas where they feel some level of expertise. This can in turn threaten self confidence unless the teacher learning is conducted in a learning environment where there is trust and respect among participants and risking existing ideas is regarded as a normal requirement for further learning.

How do other participants describe the way their teacher education programs have been modified in response to the findings from conceptual change research?

What principles have tended to guide these reforms?

How have interpretations of conceptual change altered over time?

Persistent issues and future challenges

The propositions set out in Table 1 have provided a focus for continual review of one teacher education program. However several issues have remained beyond satisfactory resolution and some of these are outlined below to stimulate thought and discussion.

* At preservice, level, the school experience is crucial in providing the range of experiences needed for prospective teachers. In our case school experience is often criticised as being restricted to an artificial classroom experience. A frequent response is that there is little connection between the campus program and the school experience. Providing a school experience which is a more valid representation of the teacher role remains an area requiring further attention, and closer collaboration with schools will be necessary.

Are there any examples of changes in teacher education approaches which have extended to restructuring of the school experience components?

* With many staff involved in teacher education programs the organisation of activities and experiences tends to occur within subject or course compartments. Yet the set of propositions imply an extensive level of integration (see especially Proposition 1 in Table 1) and this has not been easy to achieve across the total program.

Are participants able to describe any ways in which teacher education programs have been reorganised to fit in with more constructivist ideas of learning to be a teacher?

* Proposition 4 (see Table 1) highlights an aspiration that prospective teachers will gain first hand experiences of the range of teaching/learning approaches being presented. The research collaboration between teachers and academics referred to earlier in this paper has resulted in a range of teaching/learning strategies designed to promote more active learning. Many of these strategies have been adapted to the more adult and vocational purposes of teacher education.

What new teaching/learning approaches have been introduced into teacher education programs in response to findings from conceptual change research?

* Proposition 3 (see Table 1) refers to the range of experiences which should be made available to prospective teachers. We would argue that a teacher education program must provide significant experiences in three areas.

(i) Content knowledge and skills - to increase expertise in the relevant academic discipline areas and provide the confidence and skills necessary to monitor and if necessary revise existing ideas.

(ii) Knowledge about teaching, learning and students - to provide a wider range of experiences than have been gained in formal education and to provide the confidence and skills necessary to reflect on their practice as teachers.

(iii) Knowledge about self - a necessary pre-requisite to developing a self-image as a teacher.

We are continually searching for activities and experiences which may contribute to concep'ual change in each of these three areas.

Do participants have any ideas or activities designed to facilitate conceptual change in any of these areas of the teacher education curriculum?

* In responding to the ideas emerging from conceptual change research our teacher education program has been criticised as being too preoccupied with a "learning to teach" focus. For some, the program has neglected topics and experiences which should be part of any comprehensive teacher education program (e.g. comparative education issues, sociology of curriculum). One response has been to present preservice education as the first stage of teacher education (see proposition 5, Table 1) and provide opportunities to link preservice experiences with inservice activities. A broader teacher education becomes an outcome when teachers are involved as career-long learners about teaching.

In what ways have other participants encouraged the idea of career-long education and perhaps linked preservice and inservice work?

How have changes in teacher education programs been received?

What constraints have operated to limit the discussion and introduction of ideas emerging from conceptual change research?

The SIG meetings have been a valuable way of getting to know people with similar interests in research. I hope this paper and the round-table discussion initiates a more detailed discussion of the way our research effort has affected our role as teacher educators.

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23 March 1992
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